AlSb/InAs HEMTs and their Integration with RITDs

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Abstract

Future system applications that demand low-power consumption will require transistors that perform optimally at very low drain voltages. AlSb/InAs HEMTs have intrinsic advantages for next generation high-speed, low-power amplifiers and logic circuits in applications that require light-weight power supplies, long battery lifetimes, improved efficiency, or high component density. They are potential candidates for these applications due to the attractive material properties of this heterojunction material system that include high values of mobility, channel conductivity, and peak electron velocity at low electric field. For example, intrinsic f_T values of 250 GHz have been obtained at V_{DS} = 600 mV and an f_T of 90 GHz has been measured at V_{DS} = 100 mV. Also simulations of MOBILE circuits biased at 0.4 V show a power dissipation of 0.3 mW/gate at 20 GB/s. The potential payoffs associated with this material system are, however, dependent on further improvements in the technology. One key issue is the reduction of the gate leakage current, which is a common problem in AlSb/InAs HEMTs. The leakage current impacts LNA performance by compromising the noise figure and presents design issues in MOBILE-based logic circuits. In this talk, the current status of the design, fabrication, and characterization of Sb-based HEMTs at NRL will be presented including 1/f noise characterization, the use of an InAsSb channel and a TiW/Au gate metalization, and their integration with RITDs.